

ASTROBIOLOGY REU PROGRAM

- Summer Research Experiences for Undergraduates (REU) program in Astrobiology at the SETI Institute
- Funded by National Science Foundation
- 11 students spend 10 weeks at the SETI Institute each summer, working on astrobiology research projects with SETI PI's at both SETI and NASA Ames Research Center
- Program funds student travel, stipend, housing, field trip to Hat Creek Radio Astronomy Observatory and Lassen Volcanic National Park, and partial funding for publications and student conference presentations

NAI DDF CONTRIBUTION

- Funded 4 additional students for the summer 2007 SETI Institute Astrobiology REU program
- Two students worked with researchers at the SETI Institute
- Two students worked with researchers who were part of the NASA Ames Research Center NAI Team
- This collaboration helped bring the two teams closer together, and exposed members of both teams to the science being done in both places

SUMMER OVERVIEW

- \circ 1st week of program
- Introductory lectures on various topics in astrobiology (i.e. origins of life, formation of solar system, search for intelligent life)
- Required trainings in lab safety, computer safety, and sexual harassment prevention
- Week-long field trip to Hat Creek / Lassen
- 2 days at Lassen with Dr. Rocco Mancinelli, focus on extremophiles and biology
- 2 days at Hat Creek doing radio astronomy with Jill Tarter using the Allen Telescope Array
- Visit to Turtle Bay Discovery Museum led by Edna DeVore to look at exhibit design, EPO
- Program also includes a graduate school panel
- Tips on how to apply to grad school Info on how to become researchers in the field of astrobiology

STUDENT TALKS

- During summer, each student gives one 20minute "journal club" presentation
- Present a research article to rest of group
- Practice doing public talks
- At end of summer, each student gives a longer talk on their summer research project.
- Present the "big picture" scientific importance
- Focus on their personal contribution to the research
- Some students are also chosen by mentors to submit abstracts to professional conferences, or as co-authors on journal articles to be published

NAI-FUNDED STUDENTS, OVERVIEW

- Teresa Cadarette: worked with Scott Sandford and Rachel Mastrapa of the ARC NAI Team
- Elizabeth Frank: worked with Jean Chiar at the SETI Institute
- Andrew Honma: worked with Janice Bishop at the SETI Institute
- Amanda Smith: worked with Jay Skiles and Hector D'Antoni of the ARC NAI Team

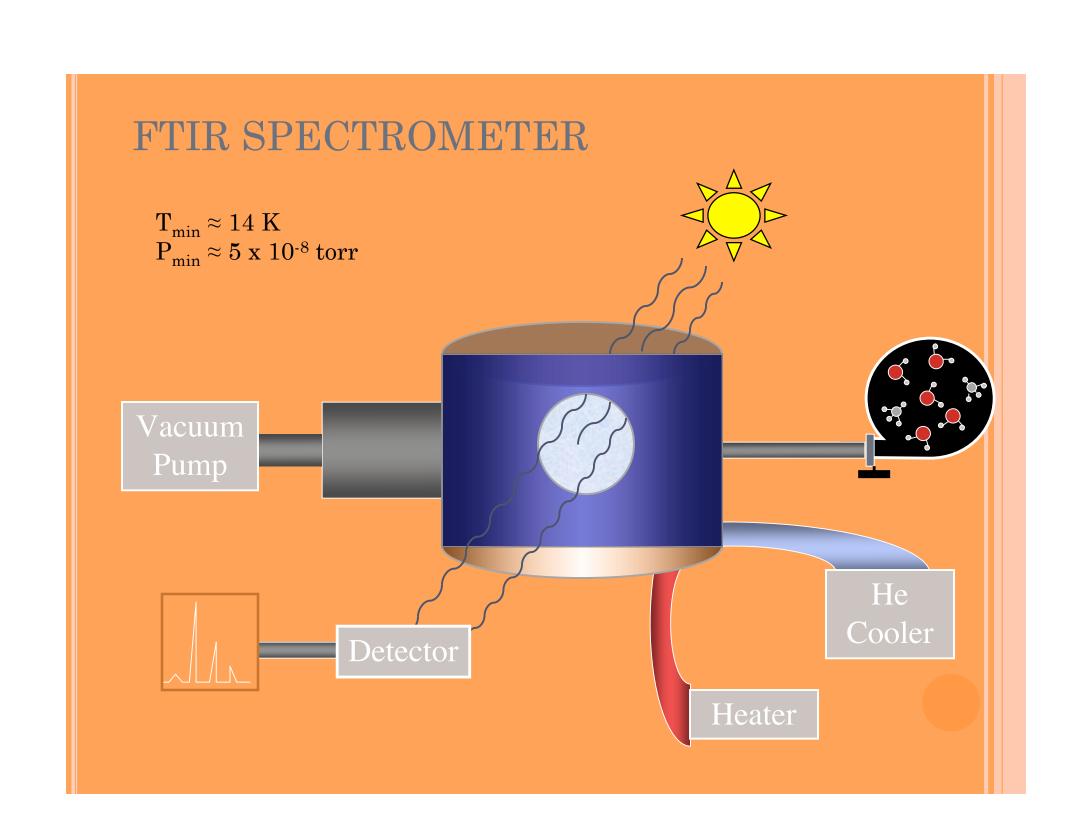
TERESA CADARETTE



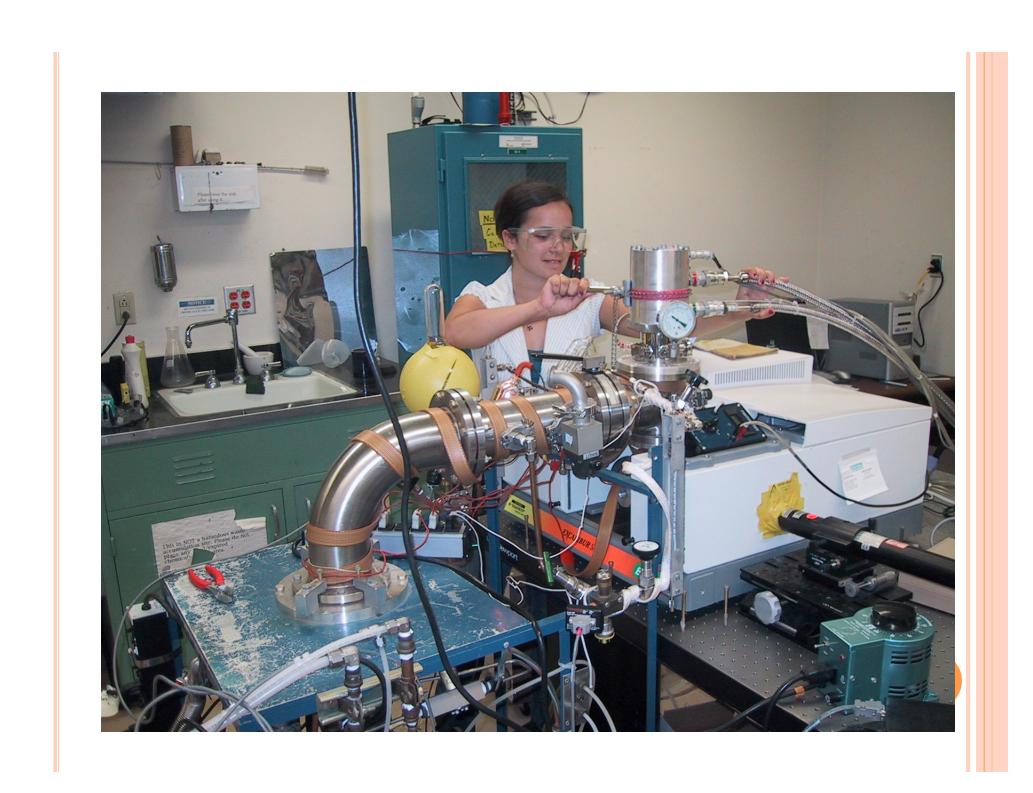
- o Mentors: Rachel Mastrapa, Scott Sandford
- o Institution: Scripps College, CA
- o Chemistry major, junior
- Project: Teresa made infrared laboratory measurements of the spectra of ices suspected to be present in the solar system.

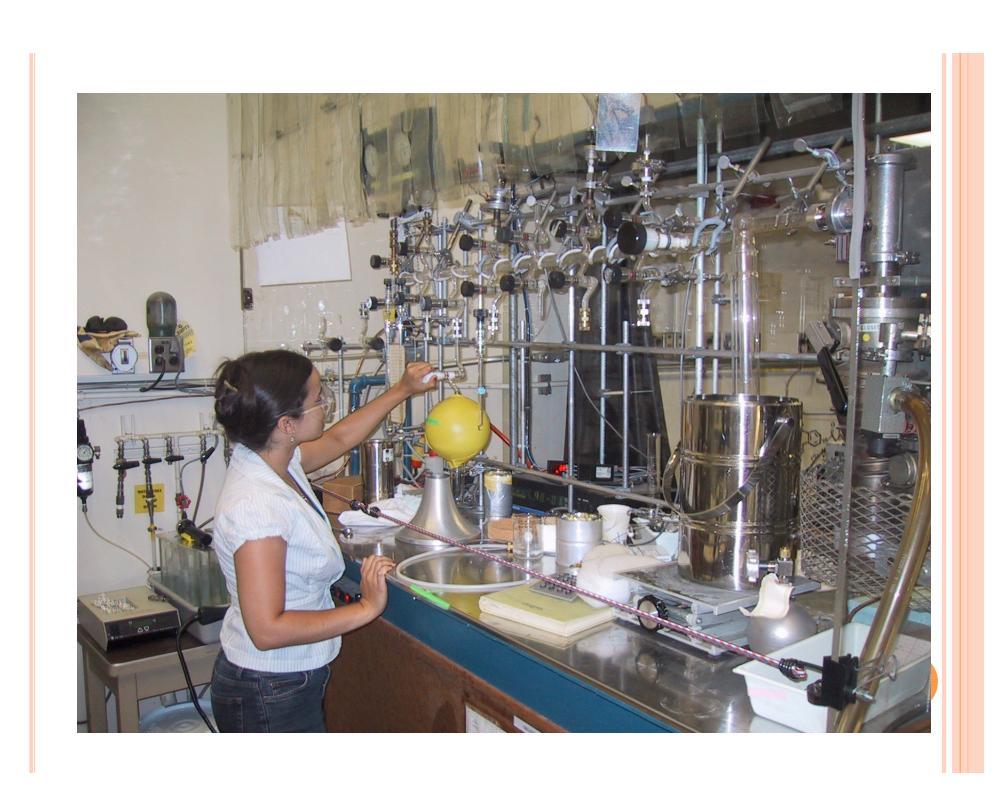
TERESA'S RESEARCH

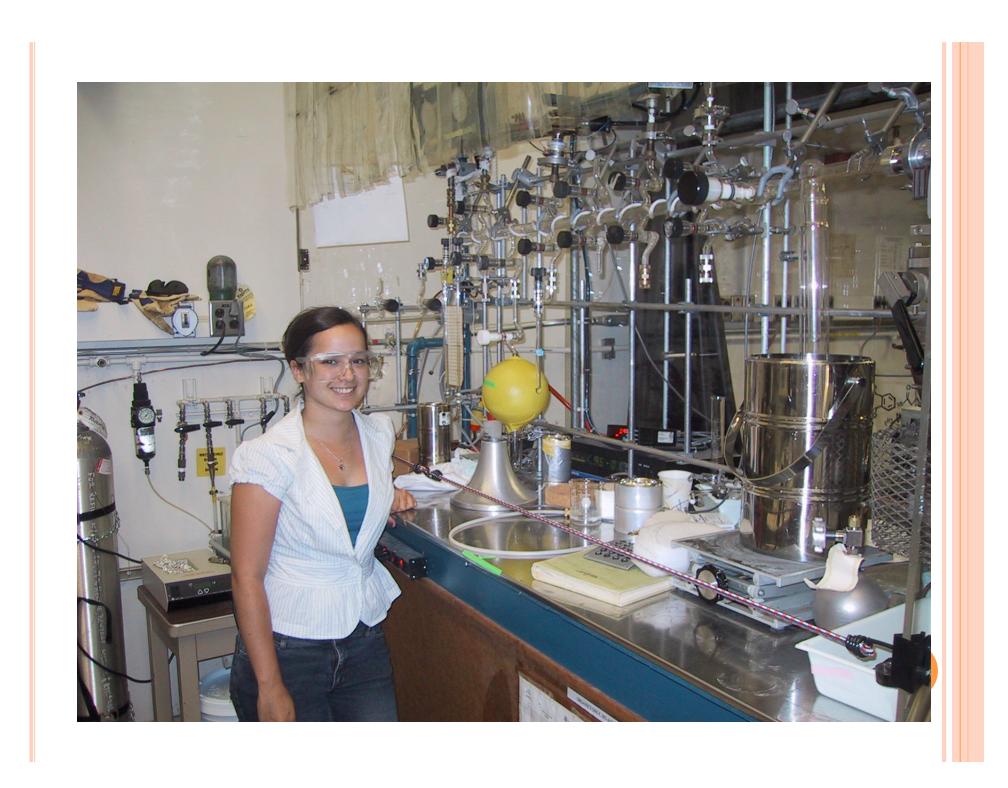
- Teresa used a cryo-vacuum system to measure the binding energies of methane, nitrogen, and water ice systems.
- She deposited mixtures of methane and nitrogen with water ice at progressively higher temperatures, until infrared absorption features were no longer seen spectroscopically
- She observed how the area of these infrared features varied with temperature, and estimated sublimation rates, residence times, and binding energies for these volatiles
- These results will help us understand the behavior of volatile species on icy surfaces in the solar system and beyond













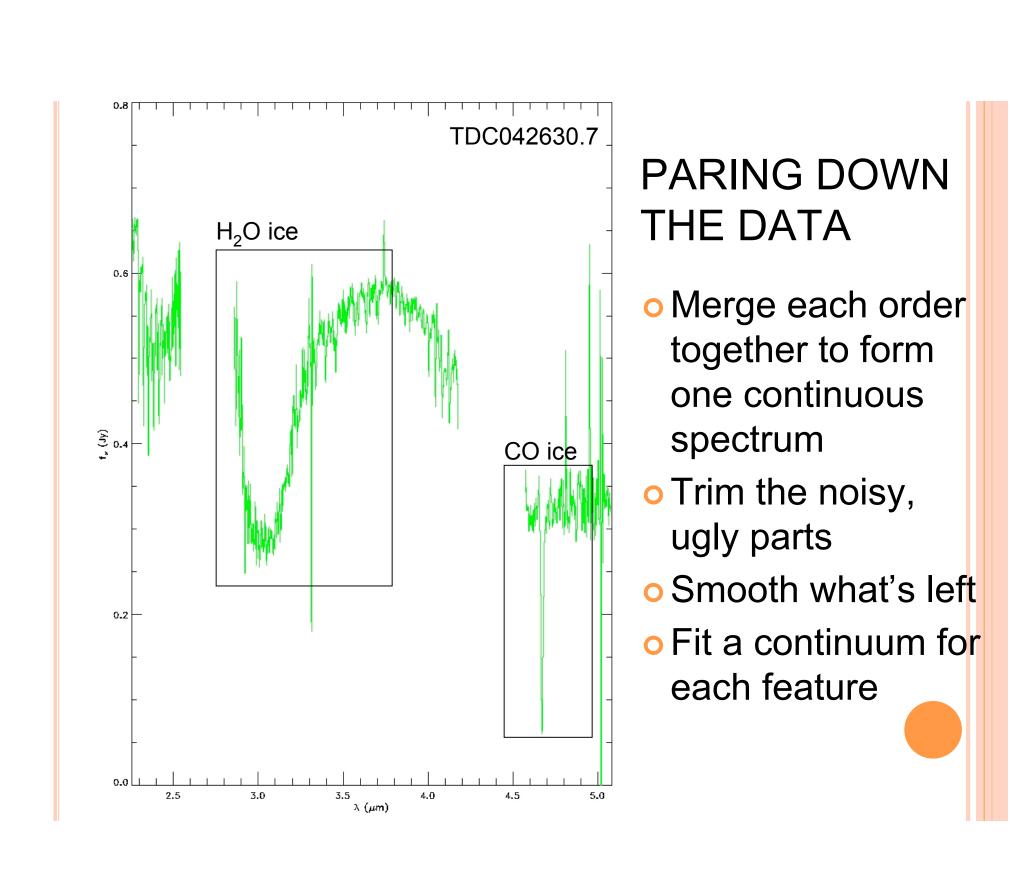
ELIZABETH FRANK

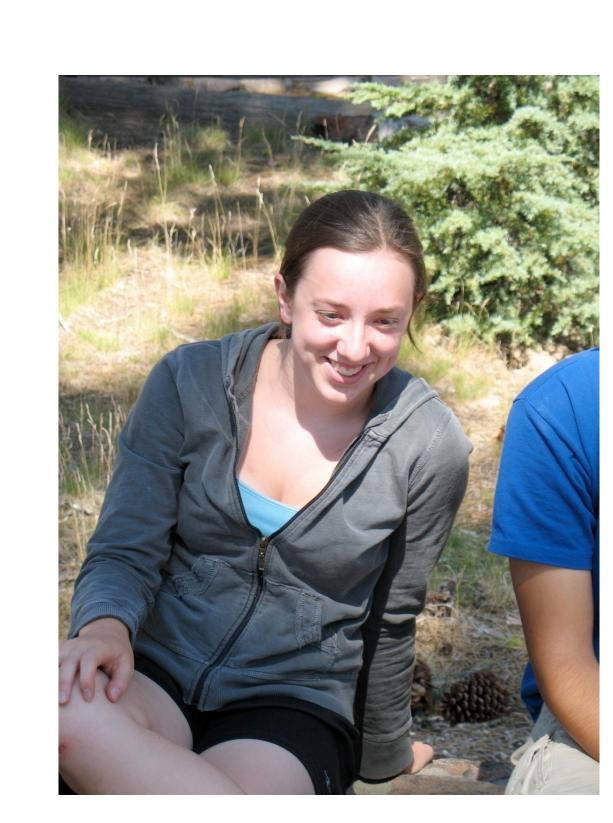


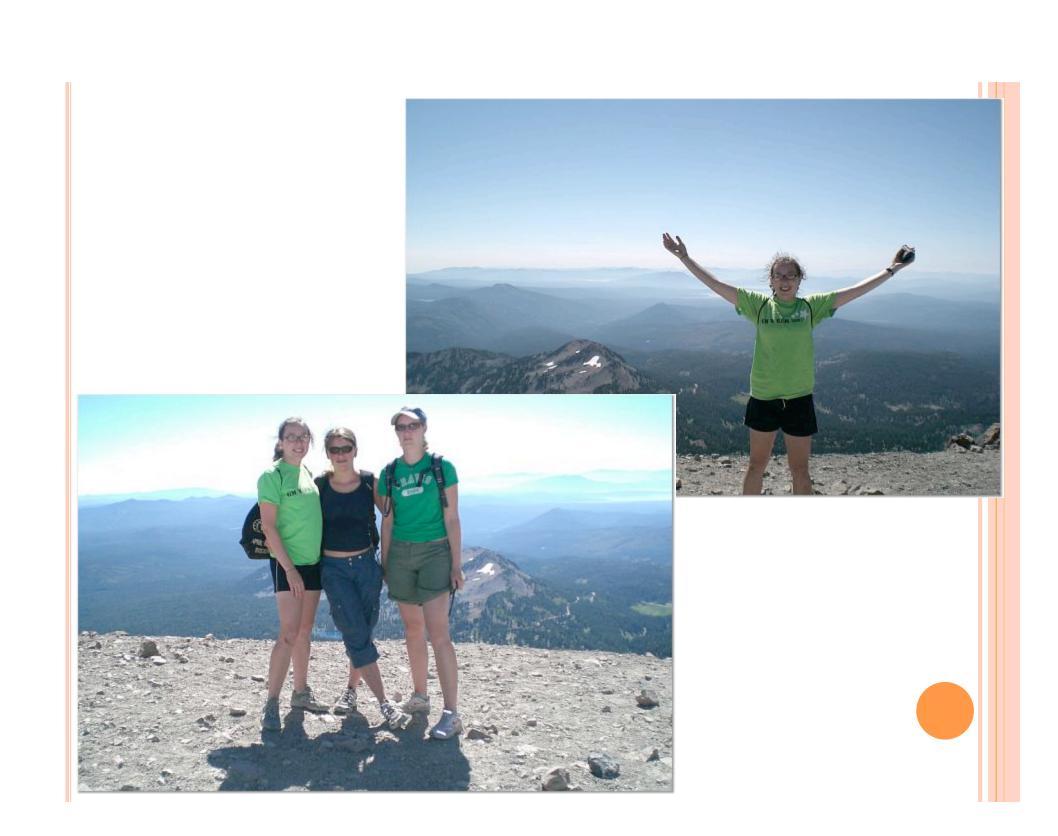
- o Mentor: Jean Chiar
- Institution: Rensselaer Polytechnic Institute (NY)
- Interdisciplinary Science major (geology / astrobiology), sophomore
- Project: Elizabeth used telescopic data to study ices in star-forming regions.

ELIZABETH'S RESEARCH

- Used spectroscopic data taken by the Infrared Telescope Facility in Hawaii to study CO and water ices in interstellar dust clouds
- Complement to Spitzer Space Telescope data, which looks at CO₂ in star-forming regions
- Processed spectral data in regions of interest
- Removed atmospheric absorption, smoothed spectra, fit to a continuum
- Looked at correlations of abundance with optical depth in dust clouds
- This work will help track the evolution of CO and H₂O in dust clouds into solar systems







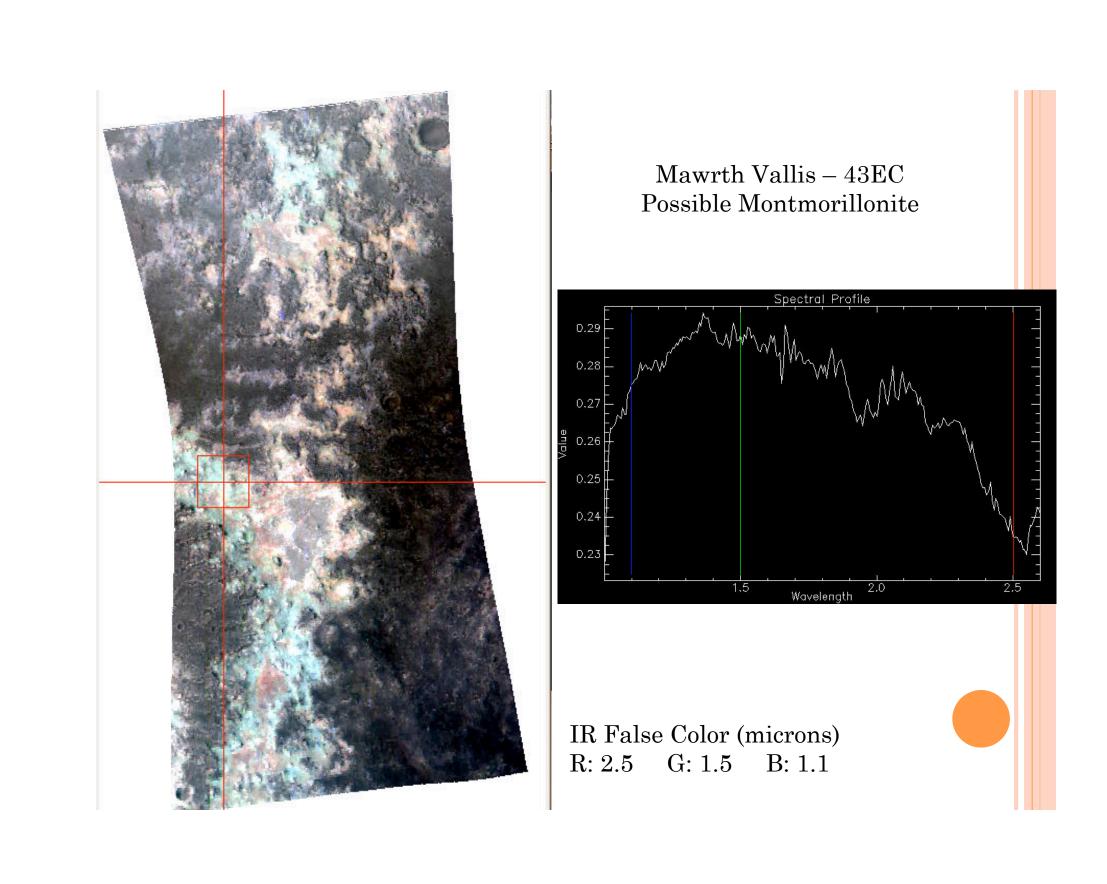
ANDREW HONMA

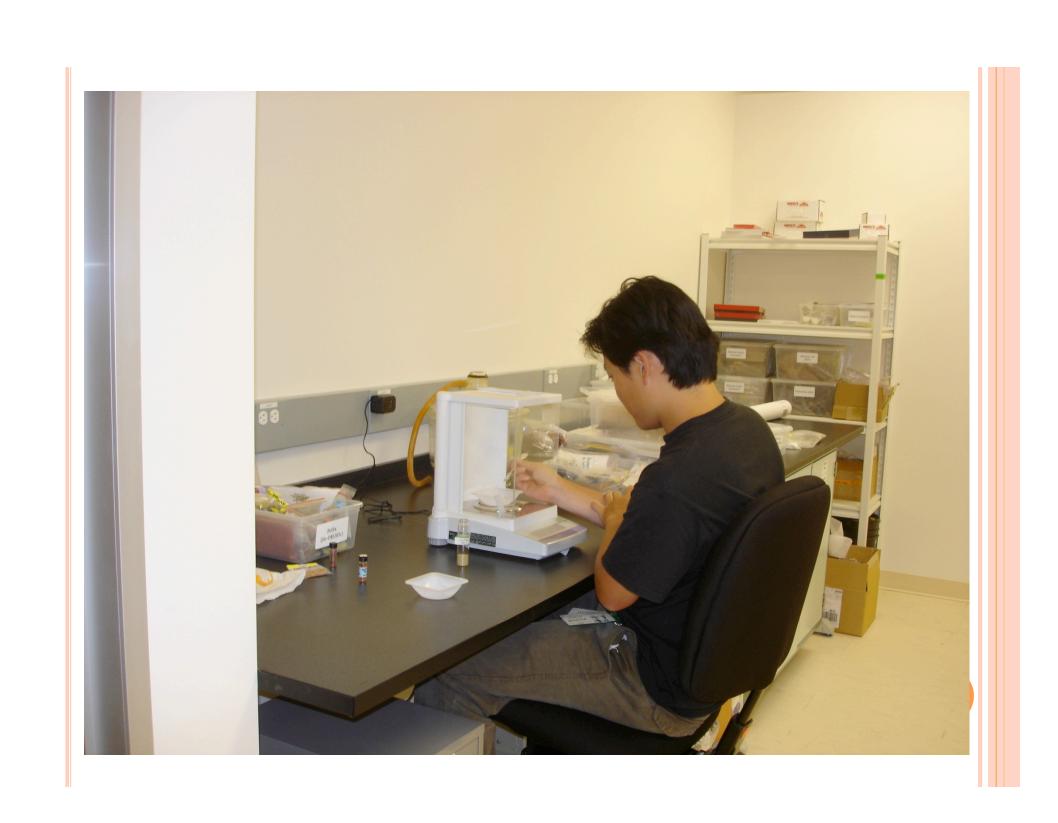


- o Mentor: Janice Bishop, Adrian Brown
- o Institution: University of Hawaii
- o Biology major, junior
- Project: Andrew compared multi-spectral measurements of the surface of Mars to laboratory data.

ANDREW'S RESEARCH

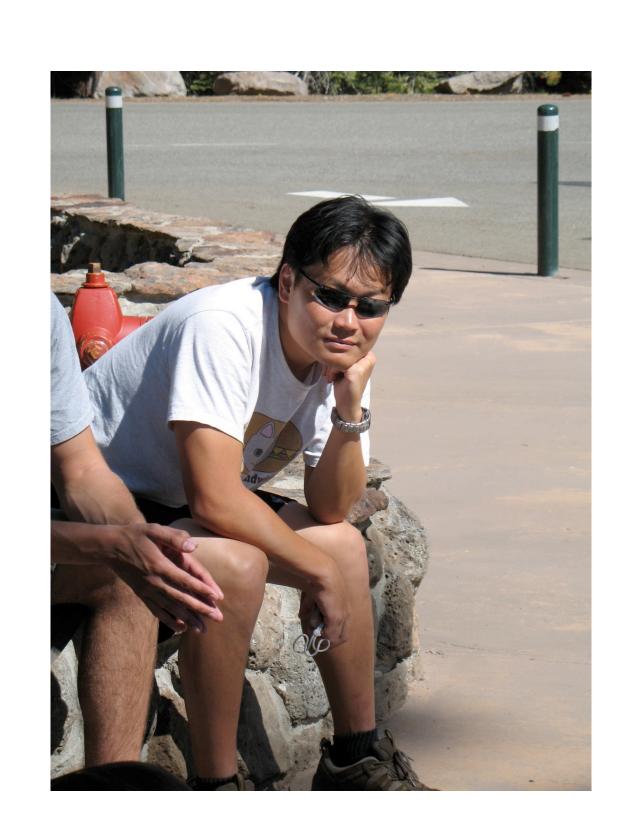
- Andrew used data from the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) instrument on the Mars Reconnaissance Orbiter (MRO) spacecraft
- He looked for evidence of Phyllosilicates (Clays), which form in the presence of water on Earth
- Made laboratory measurements of phyllosilicates such as montmorillonite, and compared them with spectral data from CRISM













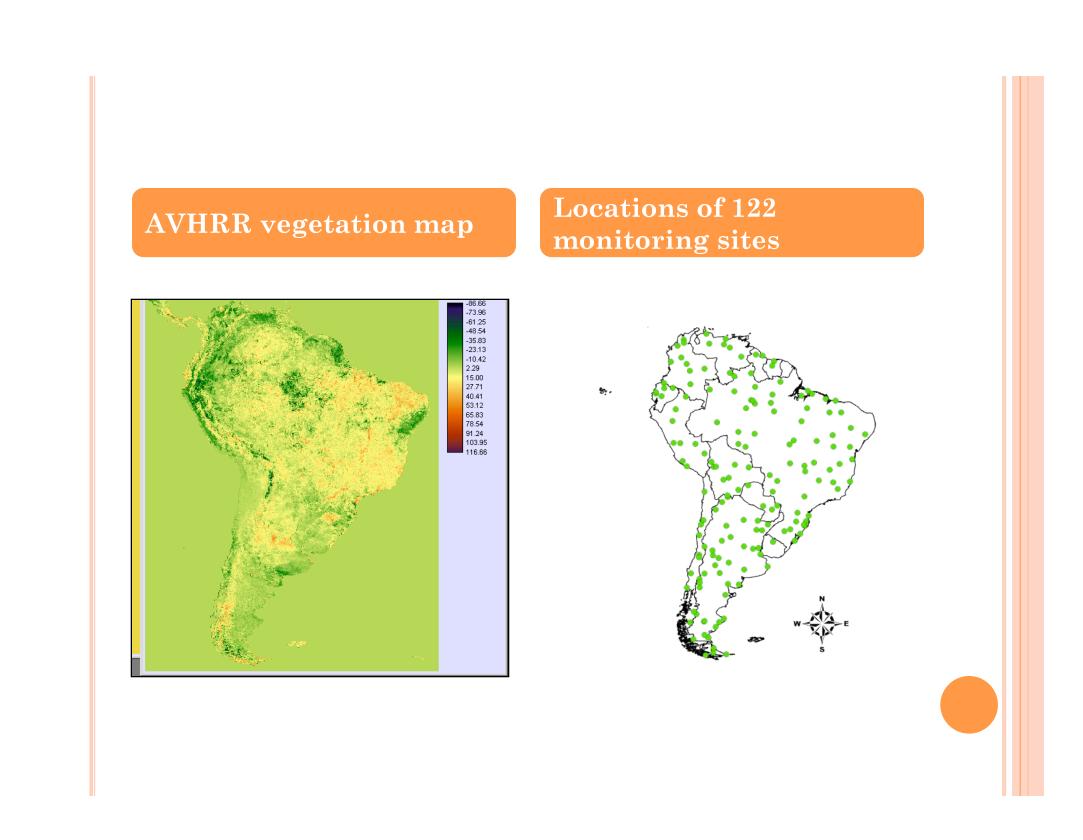
AMANDA SMITH



- o Mentors: Jay Skiles, Hector D'Antoni
- Institution:University of Virginia
- o Geology / Earth Science major, junior
- Project: Amanda studied paleoclimatology to investigate climate conditions early in Earth's history.

AMANDA'S RESEARCH

- Amanda studied satellite data from South America taken over a 20 year period, to help predict past climates and therefore study future climate change and its effect on ecosystems
- She combined satellite data with ground monitoring station data
- Satellite: Normalized Difference Vegetation Index (NDVI) data, acquired from the Advanced Very High Resolution Radiometer (AVHRR) NASA PAL database for the period 1982-2001
- Ground: tree rings, sea surface temperatures
- Amanda developed a new time-saving method to automatically extract data for all monitoring stations from the satellite data









RESULTS OF SUMMER

- Teresa gave an excellent talk on her project at the 2007 Fall AGU meeting in San Francisco
- Amanda presented a poster of her work at a summer student conference at NASA Ames Research Center
- Drew will be submitting the results of his project to the 2008 LPSC conference in Houston, TX
- Elizabeth will be a co-author on an upcoming paper

SURFACE BINDING ENERGIES OF N_2 , CH_4 , AND H_2O -ICE SYSTEMS

Mastrapa, R M, Cadarette, T, and Sandford, S A (fall AGU 2007) Abstract: We will present measurements of binding energies of the following systems: CH_4 - CH_4 , CH_4 - H_2O , N_2 - N_2 , and N_2 - H_2O determined from measurements made in a cryo-vacuum system following the methods of Sandford and Allamandola (1, 2). Briefly, for the N_2 - N_2 and CH_4 - CH_4 measurements, we monitored the area of relevant Infrared features with time at three different temperatures (<50 K) and use the results to estimate sublimation rates. For the mixtures $H_2O/CH_4 = 20$ and $H_2O/N_2 = 20$, we carried out a series of experiments in which we deposited the mixtures at increasingly higher temperatures (starting at 15 K) until the infrared features of the more volatile component are no longer seen (usually at >50 K). We then use the deposition rate of H_2O to estimate the residence time of the more volatile species (N_2 or CH_4). In previous measurements (3), binding energies of several volatile molecules (CO, CO_2 , $CO_$

